

## THE NORTH AMERICAN SPECIES OF THE GENUS SCELIPHRON (HYMENOPTERA)

BY J. C. HUTSON

### INTRODUCTION

This paper has been prepared by the writer in the Entomological laboratory of the Massachusetts Agricultural College, Amherst, as a part of a thesis for the Degree of Doctor of Philosophy. He here desires to express his debt of gratitude to Dr. H. T. Fernald for his valuable suggestions and kindly interest at all times during the progress of the work, and for his trouble in securing material from many public and private collections in the United States; to Dr. G. C. Crampton for his ready help in the anatomical portion of the paper; and to Mr. Daniel G. Tower whose preliminary notes on these insects were at the disposal of the writer, and were of no small assistance. The writer is also under great obligations for opportunities to study material from the United States National Museum, the American Entomological Society at Philadelphia, the Brooklyn Museum, and the New Hampshire State College, which had been loaned to Professor Fernald through the kindness of those in charge of these collections, and also from Professor Herbert Osborn, Dr. J. C. Bradley and many others, which were obtained in a similar way.

### GENERAL CHARACTERS

The insects of the genus *Sceliphron* of the subfamily Sceliphroninae found in North America are of medium to small size, varying from half an inch to an inch even within the same species. The wings are large in proportion to the somewhat slender body and the legs are long, especially the hinder pair. The surface of the body is almost completely covered with punctures varying in size and proximity to each other, and with hairs differing in length and density on various parts of the body. It will be noticed that the nature of the punctation bears a close relation to the size and distribution of the hairs, in that each puncture usually has its corresponding hair, though some of these are

rubbed off in older specimens. In other words the punctures mark the places of attachment of the hairs to the chitinous integument of the insect's body.

Some of these punctures are so small as to be visible only under a high powered lens and the corresponding hairs are very fine and usually decumbent. Such hairs may be seen on the dorsal segments of the abdomen and the terms "fine sericeous" or "sparsely sericeous" are applied to such areas. Similar minute but somewhat denser hairs are found on the legs and are called "sericeous" or "densely sericeous." These last are dark or whitish according to the species, while the "coarse sericeous" hairs found on portions of the fore and hind tibiae are always dark.

There are two regions in which the hairs are seen to lie flat down on the integument and are so closely set as to hide the ground color of the body, and give it a soft, satiny appearance when viewed from certain angles. The hairs in these regions are called "pubescent." One region is found along the sides of the clypeus and the frons where the hairs are silvery, and more developed in males than in females. The other region consists of two somewhat circular areas on the third and fourth ventral segments of the abdomen of *Sceliphron cyaneum* females, and the hairs in this instance vary from dark to pale brown when seen from different angles.

From the above description it may be noticed that the terms "sericeous" and "pubescent" apply to fine decumbent or semi-decumbent hairs and the chief point of distinction seems to be in their density and length, since the sericeous hairs are shorter and only partly disguise the color of the integument, while the longer pubescence may completely hide the underlying chitin.

The remaining portion of the vestiture of the body in these insects is composed of erect or nearly erect, more or less coarse hairs, which are attached to distinct punctures of varying sizes and density of arrangement. In connection with this part of the vestiture the writer has used the terms "hairs" or "erect hairs," coupling with them various words to denote gradations in density and coarseness. The coarsest hairs are found on the clypeus, the genae, the "end" and "sides" of the propodeum,

the sternum of the mesothorax, and the coxae. The hairs on the "dorsum" of the propodeum, the thoracic pleura, the prothoracic lobes, the dorsal surface of the petiole and the undersides of the trochanters and femora are perhaps not quite so dense and coarse as those in the first class, but the gradations are so slight that no marked line of distinction can be drawn. The smallest erect hairs occur on the dorsal portion of the sixth or terminal segment of the female abdomen and along the sides of the ventral portions of the abdominal segments in males and females.

Certain areas of the integument are marked by more or less parallel grooves known as "striations," other parts by fine irregular raised lines enclosing shallow punctured areas and giving a condition known as "rugose."

These insects do not show any startling color markings or bands, the body being more or less evenly colored with shades of metallic blue, black, or green, sometimes with purple or violet reflections. As mentioned above, the actual body color is sometimes obscured by the closely-set vestiture of fine pubescence.

The wings may be dark brown to pale fuliginous, even in the same species, or they may be hyaline with fuscous tips, and in most cases may show violet to bluish reflections in certain lights.

## EXTERNAL ANATOMY

### *Head*

The head is medium to large, broader than high, and seen from above is transversely elongate. The compound eyes are large, somewhat oval structures, extending from the sides of the vertex almost to the base of the mandibles. Seen from in front they occupy together an area about equal to that which lies between them, while on a side view each eye covers about twice the area of the cheek which lies behind it. They are narrowest at the top, where they are bluntly rounded, and gradually expand towards the bottom, where they are broadly truncate with a slight emargination to receive the lateral extensions of the clypeus. The eyes may be nearer each other at the vertex than at the clypeus, as in females, or the reverse, as is the case in males of the species dealt with in this paper.

*Clypeus*.—The clypeus is roughly a trapeziform plate lying below the antennae and occupying the lower central portion of the front of the head, with its lower angles extending laterally

under the compound eyes to form part of the articulation of the mandibles. On each side of the clypeus is a narrow downward extension of the frons bounded externally by the inner margin of the eye, internally by the lateral clypeal suture, and ending below in the lower of two foveae. A second or upper fovea is also present about half way to the top of the clypeus from this point, close to the suture between clypeus and frons, but apparently in the latter plate. The lower margin of the clypeus is normally tridentate, but the relative size and shape of the teeth varies in species and individuals, as will be noted under the descriptions of species. The upper margin of the clypeus is marked by a transverse to quite emarginate suture below the base of the antennae, and the lateral clypeal sutures may be continued upward as faint lines, meeting between the antennal pits, thus forming a small triangular area above the truncated apex of the clypeus, or these lines may end at the suture, which is then distinctly emarginate and its ends curve upwards on each side almost to the bases of the antennae. The central area of the clypeus is convex, with a more or less distinct median ridge, and is covered with rather long erect black hairs and closely set coarse punctures, and may be partially clothed with a silvery pubescence.

*Frons*.—The frons lies between the clypeus and the ocelli, but extends downwards on each side between the clypeus and the compound eyes and upwards on each side of the ocellar area as far as the ocello-ocular line. This is a line from the top of the compound eye to the lateral ocellus on each side. The sides of the frons extending along the inner margin of the compound eyes are somewhat sunken below the rest of the facial area and are closely punctate. The frons as a whole is usually covered with coarse erect black hairs, and the sides are more or less clothed with fine silvery pubescence which is seen to the best advantage from behind. A short median raised line runs from between the antennae to within a short distance of the median ocellus.

*Ocelli*.—The three ocelli lie near the top of the head, forming a triangle with the median ocellus, the largest of the three, below. The base of the triangle, or postocellar line, is always greater than the distance between the median and either lateral ocellus,



and always less than the ocello-ocular line. The exact proportions vary with the species. The surface between the ocelli, or intraocellar area, is slightly raised and each of the ocelli has a slight depression at its outer base.

*Vertex*.—Behind the ocelli is a shallow oblong depression, and posterior to this there may be a raised oval area, which might be regarded as the vertex proper, but in this paper the vertex is considered that part of the head bounded anteriorly by a line through the lateral ocelli, posteriorly by the occipital ridge and laterally by the genae and tops of eyes.

*Occiput*.—The occiput is the narrow circular strip at the back of the head surrounding the occipital foramen. It is of no systematic importance.

*Genae*.—The cheeks or genae are paired sclerites at the back of the head between the compound eyes and the occiput, and extend from the vertex to the base of the mandibles. They are narrowest at the top and gradually widen ventrally, where they curve in on each side to meet between the occiput and the gular cavity, and extend laterally outwards under the eyes to meet the clypeal extensions.

The mouth parts with the exception of the mandibles do not appear to be of systematic importance, but mention may be made of the labrum, which is a narrow oblong strip attached under the lower edge of the clypeus. In pinned specimens it is usually hidden behind the closed mandibles, but if these are opened the labrum can be seen as a flap lying over the other mouth parts.

*Mandibles*.—The mandibles of females are long, rather curved, bluntly rounded at the tip, and may or may not have a tooth on the inner side according to the species. In males they are shorter and taper to a point.

The extension of the lower angle of the clypeus meets a corresponding extension of the genae and the two together furnish articulations for the mandible in the following manner. On the under part of the clypeal extension is a condyle which fits into a socket on the upper side of the mandible, while the genal piece has a facet to receive the condyle on the lower side of the mandible. There is also a median basal projection on the outer side of the mandible, serving as an attachment for muscles. This projection

fits into an emargination on the lower margins of the clypeal and genal extensions when the mandible is closed, but swings inwards leaving the emargination empty when the mandibles are open.

*Antennae*.—The antennae are situated in the middle of the frontal area and articulate in two oval sockets facing obliquely outwards, thus giving the antennae a wide range. They are of medium length, consisting of twelve segments in the female and thirteen in the male.

The proximal segment, or scape, is divided into a small basal portion, the bulb, which articulates with the head in an oval socket, and a larger part, the scape proper. The latter is to all appearances a separate segment from the bulb, but the two parts are generally regarded as one segment. The true scape is somewhat oval and enlarges suddenly after its junction with the bulb, forming the thickest part of the antenna. The second segment, or pedicel is small, rounded proximally where it articulates with the scape and truncate distally where it joins the first segment of the filament. The remaining segments constitute the flagellum or filament and are more or less cylindrical. All the segments of the flagellum, except the last, are smaller at their proximal ends, the first being noticeably so. The first three segments are of about the same length and either the first or second may be the longest according to the species. The remaining segments gradually decrease in length to the penultimate, which is the shortest. The last segment is slightly longer again and tapers distally to a more or less truncate end.

The antennae are dark in color, the scape and pedicel being either dark blue or dark green with strong hairs on the inner side, while the flagellum is dull black, but the covering of fine recumbent hairs may give it a greyish appearance.

### *Thorax*

*Prothorax*.—The prothorax falls naturally into two parts, a somewhat narrow anterior portion articulating with the head and known as the neck, and a broader part behind, which articulates with the mesothorax and is usually termed the collar. Seen from above the neck is flatly convex, narrow in front and widening posteriorly to the collar, and the angle of inclination of these dorsal surfaces to each other varies, being sometimes acute and

sometimes a right angle. The anterior dorsal margin of the neck is slightly reflexed, and is hidden within the occipital foramen into which the neck fits.

The ventral surface of the neck is shorter than the dorsal and is composed of two plates closely approximate along a median suture and together forming the episternum of Snodgrass. The anterior portions of these plates are narrow and concave, and fit closely under the convex extension of the prothorax to form with it a short cylinder which fits into the occipital foramen, and gives the head freer movement. These plates widen posteriorly into two lobes, whose posterior margins are convex and unite with the concave ventral surface of the collar to form articulations for the coxae. The small triangular sternum lies between the bases of the coxae and adds support to their articulations.

The dorsal surface of the collar is somewhat flat anteriorly, but slopes upwards, sometimes almost vertically, to a rounded crest at the back, which is divided by a median furrow into two lobes. The anterior dorsal surface may be slightly arched and almost horizontal so that it forms nearly a right angle with the posterior surface, the lobes being rounded and not prominent, or it may form an acute angle with the posterior surface, in which case the lobes are rather sharp, with their crests higher than the mesonotum.

The posterior region of the collar is somewhat vertical and extends over the anterior margin of the mesonotum which has a broad median projection under it.

Between the lateral edge of the episternum and the anterior lateral margin of the collar is a very narrow plate, called the epimeron, which has been partly telescoped under the collar. This narrow strip appears to be the continuation of the anterior margin of the neck. The epimeron suddenly grows wider ventrally and extends to the base of the coxa on each side. The collar extends ventrally as far as the epimeron and its lower posterior margin projects over a portion of the mesothorax in the form of a semicircular lobe, called the prothoracic lobe by Fernald. This lobe touches the side of the mesonotum above and covers a depression on the mesopleuron, at the bottom of which lies a spiracle.

*Mesothorax*.—The mesonotum is a broad, rather sellate plate, with its anterior margin articulating with the posterior margin of the collar and at the sides with the prothoracic lobe. Its lateral margins are somewhat emarginate to receive the tegulae and slightly reflexed, while its broadly truncate posterior margin is closely applied to the scutellum. Lying between the lateral margin and the median line on each side is a shallow groove starting from the posterior margin and extending forwards for about one-third the length of the mesonotum. Near the anterior end of each groove there is a curved incised line extending forwards for the middle third of the segment. These curved lines may be the parapsidal grooves. A short straight line can be seen lying along the anterior third of the median depression of the mesonotum. The scutellum is a rather narrow plate lying behind the mesonotum. It is distinctly raised in the middle and usually marked by a faint median depression. It has a lateral forward extension on each side, as far as the base of the fore wings and tegulae, broken by two deep cavities, a smaller one on each side of the raised central portion, and a larger cavity from which the fore wings have been evaginated. These two cavities are separated by a sharp ridge. The mesopleuron is a large plate occupying the side of the mesothorax and extending obliquely from behind the prothoracic lobe to the base of the mesocoxa, where it ends in an elevation evidently serving to prevent further dorsal flexure of the leg. The mesopleuron is bounded dorsally by part of the mesonotum, and by the overhanging edge of the scutellum, but its ventral limits are not defined. Its anterior margin shows a deep depression under the prothoracic lobe bearing a spiracle, which is protected by the lobe, but its posterior boundaries are rather vague.

This plate is divided by morphologists into three parts, the pre-episternum, the episternum and the epimeron. The episternal groove is a shallow lateral depression marked by scattered ridges and separating the pre-episternum from the episternum. The epimeron has no definite limits, but lies in the broad depression extending obliquely down the sides of the body and marked by distinct foveae. This depression is known as the metapleural groove.

There is no apparent suture or line separating the mesopleuron from the sternum or ventral plate. The latter is a large plate occupying the ventral surface between the fore and middle coxae, and marked by a distinct median suture with a shallow pit near each end. About halfway between this suture and the upward curve of the mesopleuron is a short line, sometimes appearing distinctly incised with a shallow depression around it.

The episternal groove is continued ventrally on each side and curves forward to meet behind the bases of the procoxae. This groove divides the mesosternum into the prepectus, or small portion anterior to the episternal groove, and the mesosternum proper, which extends to the bases of the mesocoxae, whose articulations it bears.

*Metathorax*.—The postscutellum is a narrow plate lying behind the scutellum to which it is somewhat closely applied and in front of the propodeum from which it is separated by a deep fissure. Its lateral extensions are from two to three times as broad as the middle portion, and have a deep cavity from which the hind wings arise, and a much shallower cavity on each side of the central portion of the plate. The posterior margins of these lateral pieces are somewhat flanged and extend over the anterior margin of the propodeum and the dorsal edges of the metapleura. Outside the cavity of the hind wings on each side is a small oval protuberance, sometimes called the metapleural lobe.

The metapleuron is a somewhat indefinite plate, with its dorsal portion lying obliquely under the hind wings and its ventral extending horizontally under the side of the propodeum. It is broad dorsally where its limits are well defined, but gradually narrows ventrally when its boundaries become rather indefinite, being more distinct in one species than the other.

The hind legs are both at the ventral posterior end of the metathorax, with the small metasternal area lying between the coxal cavities.

### *Abdomen*

The median segment or propodeum lies between the postscutellum and the base of the petiole, and is bounded laterally by the metapleura. It is really the first segment of the abdomen

which has become closely connected with the thorax, and it was regarded by early writers as part of the metathorax. Behind the propodeum is a very slender cylindrical petiole, which suddenly enlarges near its posterior end to the size of the abdomen. The petiole and its enlarged posterior portion form the second abdominal segment proper, but for our purpose it can be regarded as the first segment of the abdomen.

The propodeum, therefore, lies between the metathorax and the petiole and is fused with the former, except for a dorsal fissure separating it from the postscutellum.

Its dorsal surface or dorsum extends from behind the postscutellum to the point where the body begins to slope ventrally towards the base of the petiole. This point is marked by a more or less distinct fovea or pit. The shape of the dorsum varies with the species, since its posterior margin may be evenly rounded, or its sides may converge to a point. Its surface may be more or less striated, and a median groove may be present or absent. On each side of the dorsum is a spiracle belonging to the propodeum; this lies in the anterior half of the segment in the line of the depression which marks the limits of the dorsum. The portion of the propodeum behind the dorsum is termed the end by Fernald. It extends posteriorly as far as the petiole and its hinder margin is strongly reflexed to prevent too great dorsal flexure of the petiole. The end is bounded laterally by a faint depression extending forward on each side from the base of the metacoxa to the stigma or spiracle. This is known as the stigmatal groove. Between this groove and the metapleuron is the remaining portion of the median segment, known as the side.

The somewhat slender petiole is usually narrower basally than distally. It varies in length usually with the size of the specimen, and has a slight downward curve. At the base of the dorsal side of the petiole is a small elevator muscle called the funiculus. As mentioned above, the petiole is a slender cylinder for the greater part of its length, but enlarges dorsally near its hinder end to join the second segment of the abdomen. The sternal portion of the cylinder extends continuously to the sternum of the second abdominal segment, with which it is connected by a membranous strip. The dorsal portion of the cylinder is shorter, thus giving



the petiole proper the appearance of being cut off obliquely, and the intervening space between its posterior edge and the anterior dorsal edge of the second abdominal segment is covered over by a roundly convex plate. This plate may be regarded as the true notum and is hinged to the petiole proper along its anterior dorsal edge by a thinly chitinated strip, thus allowing considerable flexion along that region. The notum sends down a flap on each side, which extends below the edge of the sternum but is connected with it on the inner side by a membrane, so that the lower portion of the flap is free on each side. The posterior margin of the notum widens out to fit over the anterior margin of the second abdominal segment, and between the two plates is a thinly chitinated strip similar to those found between any two other abdominal segments.

The modification of the petiole may be interpreted as follows. The cylindrical portion is possibly the result of the gradual curling up of the sternum and pleuron on each side and the ultimate dorsal fusion of the pleura to form a solid tube. During this process the notum appears to have been gradually pushed backwards, until it finally came to occupy its present position as a convex plate fitting over the distal end of the cylinder. The above is only a brief suggestion as to the process through which the petiole may have passed in order to reach its present highly specialized condition, but this subject is of sufficient interest to be worked up from a morphological standpoint.

The portion of the abdomen behind the petiole is of normal size, widening suddenly to a somewhat ovate form. In females the tip of the abdomen is dorso-ventrally flattened to a blunt point, while in males the tip is more or less truncate and curved under. In females six segments are visible dorsally and ventrally, while males show seven on top and eight below. The spiracles are on the anterior dorso-lateral portion of the segments and occur on all the segments in females and males, but usually only those on the first two segments are visible in pinned specimens. The third and fourth ventral segments of the female may or may not have pubescent spots on their ventral surfaces, and the posterior margin of the third ventral segment may be sinuous or almost straight, according to the species. In males the fourth and fifth

segments are finely pubescent along their posterior margins and the third and sixth may be slightly pubescent also. These segments are flattened or even concave, giving the abdomen a compressed appearance ventrally. The genitalia are usually withdrawn inside the posterior segments so as to be almost completely hidden. In conjunction with other characters they may be used in separating males, but they have not been so employed in this paper. The sixth or terminal segment of females is modified to protect the genitalia, and at the same time to allow them free play. The ventral portion of the terminal segment is longer than the dorsal and its tip is somewhat squarely truncate. It has a flap on each side which folds together dorsally, while the triangular dorsal portion fits over the basal part of the segment.

### *Wings*

The wings are of medium size and may be either hyaline and fuscous at the tips, or evenly colored in varying shades of brown showing blue violet in certain lights. In this paper the nomenclature of veins and cells given by Cresson and used by Fernald in his "North American Digger Wasps" has been followed. It is not proposed to give a general description of the wings, but the characters of systematic importance will be mentioned in the table for separation and under the descriptions of the species. A reference to the figures at the end of this paper will furnish all the necessary details.

### *Legs*

The legs are long and slender, especially the hind pair, and in addition to the hairs and spines mentioned below, all the segments are clothed with fine to coarse sericeous hairs, dark or whitish according to the species.

All the coxae are clothed with somewhat long hairs, but have no spines; the fore and middle coxae are both smaller than the hinder pair, which articulate closer together than either of the other two pairs. The trochanters are all smaller than their corresponding coxae and have scattered hairs mostly on the inside. The femora in the three pairs of legs are all stouter than the tibiae with which they articulate, but while the fore and middle femora are distinctly longer than the corresponding tibiae,

the hind femur and hind tibia are about equal in length. The femora have no spines but are covered with rather long hairs on the inside. Round the tip of each tibia is a circle of small spines, two of which are usually longer than the others, and each tibia usually has a row of small recumbent spines on each side. The fore and hind tibiae have a densely sericeous area, the former in a small strip on the inside near its distal end, and the latter in a narrow strip along its outer side. The fore tibia has a large, somewhat modified spine with a chitinous blade and some fine hairs on its inner surface. This spine runs parallel to the first tarsal segment which has a similar modification on its outer side. This structure forms a cleaning apparatus. The middle and hind tibiae each have two strong spines of unequal length, but only the hind tibia has a cleaning apparatus, which is a little different from that on the fore tibia, as will be seen from a comparison of the figures. The tarsus in each leg consists of five segments, the first of which is much longer than any of the others and is called the metatarsus. All the tarsal segments are covered with closely set spines, those at the distal ends being longer than the others.

The last tarsal segment is provided with a pair of strong curved claws, between which is a well developed pulvillus. On the inner side of the claws near their bases there are usually two or three fine hairs, one longer and stiffer than the others, while about the middle of the inside of the claw there may be a small tooth. These teeth occur only on the claws of the fore and middle legs in these insects.

#### SENSORY AREAS ON THE ANTENNAE

In the females of both *cyaneum* and *zimmermanni* all the segments of the filament have somewhat irregularly oblong, apparently bare regions lying along their inner sides when the antennae are held curled forward. These areas appear slightly depressed and usually darker than the remaining parts of the segments, owing to the absence of the fine recumbent hairs with which the other portions are covered. When the antennae are cleared and mounted the above areas are seen to be covered with pits and hairs of various sizes, probably of a sensory nature. The structures on the male antennae appear to be more complicated, since,

in addition to depressed regions along the inner basal portion of each filamentous segment, they have somewhat oval to oblong, bare, brown to blackish areas on the distal end of these segments. These areas when cleared are seen to be covered with small pits and hairs closely packed, and are a distinct contrast to the larger and more scattered pits on the inner basal portions of the segments. These brownish areas occur, as far as could be determined, only on the seventh, and eighth segments in *cyaneum* and on the seventh, eighth and ninth, and occasionally sixth, segments in *zimmermanni*, and vary in size and shape. In both species there are also minute slightly raised areas near the basal end of all the segments of the filament, but the nature of these is undetermined. They are seen on the upper part of the inside of the segments when the antennae project forward.

#### ANALYTICAL KEYS

A very good working table of the families of the Sphecoidea is given by Ashmead<sup>1</sup> and should be consulted by those interested. The following table of the subfamilies of the Sphecidae has been taken from those given by Ashmead<sup>2</sup> and by Fernald,<sup>3</sup> with slight variations, in connection with the subfamily Sceliphroninae.

#### ANALYTICAL KEY TO SUBFAMILIES

1. Second cubital cell receiving only the first recurrent vein; the second recurrent vein received by the third cubital cell, or at least beyond the second transverse cubital. (Both recurrent veins are received by the first cubital cell in a few extra-limital forms) . . . . . 2
- Second cubital cell receiving both recurrent veins, or the second recurrent vein is interstitial with the second transverse cubitus, although sometimes the first recurrent is interstitial with the first transverse cubitus, or then received by the first cubital cells . . . . . 3
2. Antennae inserted on the middle of the face; claws with one to six teeth beneath; tibiae strongly spinous, or at least never with weak or feeble spines; tarsal comb in female present (except in *Isodontia*).

#### **Chlorioninae** (*Sphecinae* of Authors)

Antennae inserted far anterior to the middle of the face; claws simple, without teeth, or at most with a single small tooth near the middle; tibiae smooth, not spinous; tarsal comb in female never present . . . . . **Podiinae**

<sup>1</sup> Canadian Entomologist, xxxi, 152.

<sup>2</sup> *Idem*, 348.

<sup>3</sup> Digger Wasps of North America, Proc. U. S. Nat. Mus., xxxi, 308.

3. Claws simple, without a tooth beneath; tibiae more or less spinous; tarsal comb in female present; abdomen most frequently very elongate, the petiole composed of two segments, rarely only of one segment; cubital vein of hind wings usually originating beyond the transverse median vein..... **Sphecinae** (*Ammophilinae* of Authors)
- Claws simple with a single tooth beneath, although sometimes very minute; hind pair with or without a tooth; tarsal comb in female absent; abdomen always with one-segmented petiole; cubital vein of hind wings interstitial or nearly so.....4
4. Antennae inserted on the middle of the face; metathorax with a large U-shaped area above; mesopleura not longer than the height of the thorax..... **Sceliphroninae**
- Antennae inserted far anterior to the middle of the face, on or just above an imaginary line drawn from base of eyes; metathorax without a large U-shaped area above; mesopleura much longer than the height of the thorax..... **Podiinae**

#### KEY TO GENERA OF SUBFAMILY SCELIPHRONINAE

Second cubital cell receiving both recurrent veins.

Species black and yellow, not metallic; clypeus flat, bidentate at apex; transverse median vein in front wings not interstitial with basal vein, but uniting with the median vein a little before the origin of the basal nervure; petiole of abdomen about twice as long as the median segment.

**Pelopaeus** Latreille

Species metallic blue or violaceous; clypeus normally tridentate anteriorly; transverse median vein in front wings interstitial with the basal vein; petiole of abdomen not longer than median segment. **Sceliphron** Klug

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- Abdomen without pubescent spot on third and fourth ventral segments; whitish hairs on dorsum of median segment... **zimmermanni** Dahlbom
3. Body dark blue black or blue green, hairs almost entirely dark.  
**cyaneum** Klug
- Body paler, hairs almost entirely whitish, wings fuliginous to hyaline with fuscous tips..... **zimmermanni** Dahlbom

#### Genus **SCELIPHRON** Klug

*Sceliphron* Klug, Neuschrift Ges. Naturf. Freunde, Berlin, iii, 1801, 561.

*Chalybion* Dahl., Hym. Eur., i, 1843, 21.

*Chalybion* Patton, Proc. Bost. Soc. Nat. Hist., xx, 1880, 378.

Genotype—*Chalybion caeruleum* (= *cyaneum* Dahlbom), designation of Patton.

Body metallic blue black or blue green, sometimes with violet reflections. Clypeus normally tridentate, but teeth vary in size and shape. Metapleural sutures indistinct. Claws of posterior tarsi unarmed. Petiole of abdomen somewhat variable in length, but never as long as median segment.

The genus *Sceliphron* was established, in 1801, by Klug, who included five species under it, viz: *spirifex*, *madraspatanum*, *lunatum*, *cyaneum* and *fuscum*. In 1802, Latreille<sup>4</sup> established the genus *Pelopaeus*, giving *Sphex spirifex* Linnaeus and *S. lunata* Fabricius as examples, and in volume xiii of the same work (1805), besides describing these species under *Pelopaeus*, mentioned that Klug had called the genus *Sceliphron*. In 1843, Dahlbom<sup>5</sup> established the genus *Chalybion*, separating it from *Pelopaeus* on a color basis, with *violaceum* Fabricius, *zimmermanni* new species, and *cyaneum* Linnaeus as species, and at the same time included *spirifex*, *lunatum* and several other species under *Pelopaeus*. Two years later, in his tabulation of species on page 432 of the same work, he mentioned *Pelopaeus* as a genus, with *Chalybion* and *Pelopaeus* as sub-genera, since no additional characters could be found to justify separation. *Chalybion* remained under *Pelopaeus* until 1880, when Patton<sup>6</sup> gave distinctive characters in addition to color, sufficient in his opinion to establish *Chalybion* and *Pelopaeus* as separate genera, and with this the writer agrees.

It will be noticed that the species removed from *Sceliphron* by Latreille are black and yellow, while *cyaneum* remaining is blue, and *fuscum* is apparently unknown to modern workers. Accordingly the separation of *Pelopaeus* from *Sceliphron* leaves *cyaneum* as its type, in accordance with recommendations *k.* and *n.* of the International Rules of Nomenclature. Patton's designation of *cyaneum* as the type of *Chalybion* would therefore make this genus a synonym of *Sceliphron*, as restricted by the removal of the species placed under *Pelopaeus* by Latreille.

*Pelopaeus californicus* Saussure is regarded by the writer as conspecific with *cyaneum*, since he has examined a number of specimens from California, all of which are similar to *cyaneum*,

<sup>4</sup> Hist. Nat. Crust. et Ins., iii, 334.

<sup>5</sup> Hym. Eur., i, 1843, 21.

<sup>6</sup> Proc. Bost. Soc. Nat. Hist., xx, 1880, 378.



and he does not consider the shorter petiole of sufficient importance to justify separation. In this the writer agrees with Patton.

### Descriptions

#### **Sceliphron cyaneum** Klug

It has been found advisable to give only the more important references on this species.

*Sceliphron cyaneum* Klug, Neuschrift Ges. naturf. Freunde, Berlin, iii, 1801, 561.

*Pelopaeus cyaneus* Lepeletier, Encycl. Méthod., Ins., x, 1825-33.

*Chalybion cyaneum* Dahlbom, Hym. Eur., i, 1843, 21.

*Pelopaeus (Chalybion) cyaneus* Dahlbom, Hym., i, 1845, 432.

*Pelopaeus caeruleus* Lepeletier, Hist. Nat. Ins., Hym., iii, 1845, 320.

*Pelopaeus caeruleus*, Jones, Naturalist in Bermuda, 1859, 113.

*Pelopaeus (Chalybion) caeruleus* Saussure, Reise Novara, Zool., ii, 1867, 26.

*Pelopaeus (Chalybion) californicus* Saussure, Reise Novara, Zool., ii, 1867, 26.

*Pelopaeus Californicus* Patton, Proc. Bost. Soc. Nat. Hist., xx, 1880, 379.

*Chalybion caeruleum* Patton, Proc. Bost. Soc. Nat. Hist., xx, 1880, 378.

*Pelopaeus caeruleus* Provancher, Natural. Canad., xiii, 1882, 12.

*Pelopaeus caeruleus* Provancher, Faun. Entom. Canad., Hym., 1883, 613.

*Chalybion caeruleum* Cameron, Biol. Centr.-Amer., Hym., ii, 1888, 25.

*Chalybion (Pelopaeus) Californicum*, Cameron, Biol. Centr.-Amer., Hym., ii, 1888, 25.

*Chalybion caeruleum* Schwarz, Proc. Ent. Soc. Wash., i, 1890, 254.

*Pelopaeus caeruleus* Peckham, Wis. Geol. and Nat. Hist. Surv., Bull. 2, 1898, 176, pl. ii, fig. 5; pl. x, figs. 1-3.

Fernald's paper<sup>7</sup> discussing the name *caerulea* of Linnaeus and others, clearly shows that this name cannot be applied to the species here considered, leaving *cyaneum* Klug as the first name available.

*Types*.—There is a specimen (seen by Fernald in 1913) from North America in the Berlin Museum bearing a label *cyaneus*, stated by the authorities there to be in Klug's handwriting. It is a small male, undoubtedly of this species. No specimens in that collection were found which appear to have been labelled by Dahlbom. At Lund are eighteen specimens, the first marked "Chalybion caeruleum, Sphex Lin. Pelopaeus Pelet. ♂ ♀ New York." This specimen is a male and it is to be inferred that Dahlbom at the time of labelling this specimen was confusing it with *Chlorion caeruleum*. This confusion has already been discussed by Fernald.<sup>8</sup>

<sup>7</sup> Ent. News, xv, 117, 1904.

<sup>8</sup> See above.

The types of *californicus* Saussure have not been seen, but are presumably at Geneva.

The following description has been made from fifteen females and the same number of males, selected from a large number of specimens and covering as wide a distribution as possible.

Metallic blue black or blue green, sometimes with purple reflections, especially on legs and abdomen; head and body except abdomen thickly pilose, pubescence silvery on sides of frons, dark on third and fourth ventral segments of female abdomen; remainder of body covered with fine dark sericeous hairs, more or less concealed by pilosity, except on legs and abdomen. Wings varying from pale to dark fuliginous.

*Female*.—Head across the eyes broader than thorax across the tegulae; clypeus sloping abruptly at sides down to depressed areas of frons, somewhat flat in center with surface closely punctured and covered with dark erect hairs and finer dark sericeous hairs; these are best seen from the side and vary in density with individuals; anterior margin of clypeus black, extending laterally under the eyes, armed near the middle with three blunt teeth (the median tooth generally the smallest), and a small lateral process on each side varying in size, but never as large as the central teeth; a row of strong black hairs projects forwards over the teeth; posterior margin concave, bending round at the sides to join the clypeal sutures, which form the lateral boundaries of the clypeus; central portion of clypeus with a median line appearing as an irregular shiny strip; surface of frons channelled on each side of the antennal elevation and clypeus; these depressions together with the antennal region are closely punctate, the punctures being somewhat confluent and smaller than those on the clypeus with correspondingly smaller hairs; there is also a fine silvery pubescence on the sides of the frons seen best from behind; antennal region divided by a distinct median elevated line extending from between the antennae to within a short distance of the median ocellus; intra- and circum-ocellar areas finely punctured and with small erect black hairs; surface of vertex rather sparsely punctured with a few long black hairs on a slightly raised area behind the ocelli; occiput covered with fine punctures and shorter black hairs, sometimes densely sericeous; genae clothed with long erect black pilosity, interspersed with fine sericeous hairs thickest along the hinder margins of the eyes and the lower portions of the genae, and giving these parts a coppery reflection when seen from behind; inner margins of compound eyes more concave than those of males and more convergent posteriorly than anteriorly; antennae with scape and pedicel blue black or blue green, generally metallic with a few black hairs mainly on inner side and surface covered with very fine dark hairs; flagellum or filament dull sooty black or greyish black, owing to the presence of minute recumbent hairs; first segment of the filament usually slightly the longest, the remaining segments very gradually decreasing in length until the last, which is usually a little longer than either the penultimate or ante-penultimate; last segment tapers distally but is somewhat squarely truncate at its distal end; mandibles long, narrow, curved, without teeth, rather bluntly pointed, sometimes worn down

so as to be roundly truncate at tip, black or blue black for basal half, gradually shading to pale brown at distal end, with a groove along upper and lower margins, sometimes with fine hairs, and a strong groove at external basal end with a few stout black hairs; there is also a row of short hairs on the inner face, but these are usually hidden when the mandibles are closed.

*Thorax*.—Neck may be slightly rugose with sparse punctures and small hairs; collar narrower than remainder of thorax, sides almost vertical, laterally compressed with a central depression ending dorsally in a deep fovea; the anterior dorsal surface may form an acute angle with the posterior surface making the lobes somewhat sharp, or it may slope gradually upwards making these more rounded; median dorsal groove may be transversely striated; dorsal surface, sides and episterna strongly punctured and covered with erect black hairs interspersed with a fine brownish vestiture; prothoracic lobe with small scattered punctures and hairs, posterior edge fringed with short delicate pale brown hairs; mesonotum with a distinct median depression for its anterior half, surface strongly and closely punctate and covered with somewhat erect black hairs; scutellum also with median groove, but not so closely punctured as mesonotum, postero-lateral margins of lateral depressions fringed with fine pale brown to silvery hairs; postscutellum finely punctured in center, lateral extensions fringed posteriorly with small light brown to whitish hairs; mesopleura and mesosternum covered with strong punctures and coarse black hairs interspersed with minute coppery hairs; metapleura and metapleural grooves somewhat sparsely punctate, the latter sometimes almost bare and shiny; median segment with dorsal shield bounded by a linear V-shaped depression and broadly rounded at posterior margin, where there is a small but deep fovea; this depression may be transversely marked by ridges on each side both anterior and posterior to the spiracle, but these raised lines usually end where the sides begin to curve round posteriorly; dorsum with a distinct median depression, rather faint anteriorly where the shield has a gradual upward slope, surface of shield usually with no markings other than rather small, often confluent punctures, but may be rugose, hairs medium sized; sides and end usually with more distinct punctures, small at sides of shield, coarser at posterior end, pilosity to correspond; petiole stouter at distal end before suddenly enlarging to size of abdomen, punctures fine, hairs slender and rather scattered, finely sericeous mainly in upper distal surface.

*Abdomen* of medium size, somewhat ovate, shining, arched dorsally, flatter ventrally, pointed behind, almost the whole dorsal and ventral surfaces covered with minute dark decumbent hairs, giving the abdomen a dirty appearance in certain lights without obscuring the body color; first three dorsal segments without coarse punctures or stout hairs, last three with small punctures and scattered hairs, a row of fine punctures along the hinder margins of the first two of these segments, but the corresponding hairs very rarely complete; sixth or terminal dorsal segment with a group of small punctures and hairs on each side nearest the anterior margin, but central portion bare except for minute hairs; sixth or terminal ventral segment with a narrow punctate strip on each dorsal flap sparsely covered with small hairs of varying sizes, ventral surface covered with fine hairs except for a bare median

strip; fifth ventral with a few scattered punctures and hairs; fourth with a black or brown pubescent area on the middle of the posterior part of the segment and a few hairs on each side (Fig. 3); third bears a smaller similarly colored pubescent area and a deeply sinuate double row of hairs extending across the segment behind the pubescent area, but if the abdomen is at all telescoped these cannot always be seen; posterior margin of third segment sinuate; second segment with a V-shaped double row of hairs; in all of the above cases the hairs may be missing, but the punctures can still be seen.

*Wings* vary from pale to dark fuliginous, with violet to purple reflections except at tips, which are dull and sometimes darker than the basal portion of the wing; fore wings have no distinctive characters apart from those shown in the figures; tegulae blue green or blue black, sometimes with purple lights, shining, paler at margins, finely sericeous for basal half, hairs dark; hind wings, angle between median and transverse median usually greater than a right angle; discoidal leaves cubital slightly exterior to junction of median cubital and transverse median.

*Legs* colored with various shades of blue, black or green, sometimes with metallic purple reflections; coxae and trochanters blue black or greenish black, sometimes dull purple in old specimens, strongly punctured especially on ventral side, with long black hairs and fine brown sericeous vestiture; femora and tibiae colored much the same as the preceding segments, femora with rather long black hairs on ventral side and minute brown hairs over the whole surface, fore and hind tibiae finely sericeous, with a coarser brown sericeous area along inner surface; tarsi may be dark to purplish or the sericeous hairs may give them a brownish appearance; claws dark brown for basal half, paler at tips; spines on legs black to brown.

*Male*.—Differs from female as follows: Body usually more hairy; eyes more approximate below than above; clypeal teeth small and rather pointed, no side processes; frons less sunken at sides of clypeus; mandibles of medium size, pointed at tip; antennae with thirteen segments; second segment of flagellum longer than first; dorsal lobes of collar usually somewhat more acute; abdomen more compressed ventrally, especially the last few segments, tip curved under; seventh or last dorsal segment evenly rounded, covered with short black hairs chiefly at sides, hinder margin bearing a pair of genital palpi one on each side, sixth, fifth, fourth and third dorsal segments with one, sometimes two rows of small punctures near hinder margins, but corresponding hairs often absent; eighth or terminal ventral segment usually drawn in so that only the lobed distal portion projects beyond the hinder margin of the seventh ventral and covers the anal opening; this lobe is here termed the hypopygium, but has been given various names by different authors, it is covered with short erect hairs seen best in profile; seventh ventral segment bare, sixth finely sericeous; fifth and fourth finely sericeous in center, punctate at sides; third with anterior margin sericeous and a sinuous row of punctures anterior to it; second with a deeply sinuous row of punctures and hairs.

*Length*.—Females, 15 to 23 mm.; males, 12 to 18 mm.

*Distribution.*—This species is widely distributed throughout North America, and the writer has examined specimens from southern Canada, the eastern United States from Maine south along the east coast to Florida, then west through the Gulf States to southern California as far north as San José, then east again through Nevada, Utah and north to the Great Lakes. This insect also occurs in southeastern Montana but, as far as the writer knows, does not extend over the Rocky Mountains to the northern Pacific Coast region. He has also seen specimens from the central Gulf Coast of Mexico.

This species, therefore, as known to the writer, seems to be an Austral form, occurring mainly in the Upper and Lower Austral with frequent specimens in the Transition Zone.

*Habits.*—The members of the sub-family Sceliphroninae are collectively known as Mud-daubers, and this beautiful species is called the Blue Mud-dauber. The females can be noticed during the early summer months flying in and out of barns, outhouses, porches or any sheltered place, and if followed up may be seen at work on their small earthen nests, which are usually placed fairly high up near the roof.

The writer has had little opportunity of studying the habits of these insects, so that he cannot do better than to refer to the interesting observations made by Mr. and Mrs. Peckham<sup>9</sup> on the habits of this species, there called *Pelopacus caeruleus*. These observations were made over a period covering a number of years and are of great interest and importance, especially those on the methods employed by the wasps in capturing and stinging their prey.

**Sceliphron zimmermanni** (Dahlbom)

*Chalybion Zimmermanni* Dahlbom, Hym. Eur., i, 1843, 22.

*Pelopacus (Chalybion) Zimmermanni* Dahlbom, Hym. Eur., i, 1845, 433.

*Pelopacus (Chalybion) Aztecus* Saussure, Reise Novara, Zool., ii, pt. 1, 1867, Hym. 26.

*Pelopacus (Chalybion) zimmermanni* Saussure, Reise Novara, Zool., ii, pt. 1, 1867, Hym. 26.

*Pelopacus texanus* Cresson, Trans. Amer. Ent. Soc., iv, 1872, 210.

*Chalybion zimmermanni* Patton, Proc. Bost. Soc. Nat. Hist., xx, 1880, 379.

<sup>9</sup> Instincts and habits of the Solitary Wasps, by G. W. and E. G. Peckham. Wis. Geol. and Nat. Hist. Survey, Bull. No. 2, Sci. Ser. No. 1, 1898, p. 176.

*Chalybion texanum* Patton, *idem*.

*Chalybion aztecum* Patton, *idem*.

*Chalybion zimmermanni* Cameron, Biol. Centr.-Amer., pt. 71, 1888, Hym., ii, 25.

*Chalybion aztecum* Cameron, *idem*.

*Types*.—Dahlbom evidently described *zimmermanni* from at least two specimens, since he records both male and female. In the Berlin Museum there is a specimen labelled with this name, but so far as could be ascertained by Fernald, who examined it in 1913, the only difference from *cyaneum* was that the dorsum of the propodeum was slightly cross striate which, as has been shown, is not distinctive. At Lund there are several specimens, the first a male being labelled "Zimmerm N. Amerika" on the upper label and "Zimmermanni Dlbm. sp. ign." on the second. On the dorsum of the propodeum of this specimen are traces of transverse ridges, the thoracic hairs are white and wings quite fuliginous. Another specimen is labelled "E. Sud Carolina a Zimmermann." The writer is inclined to regard the first named specimen from Lund as representing at least one of the original specimens used by Dahlbom and the one at Berlin as not *zimmermanni* at all.

The types of *aztecus* Saussure have not been seen, but are probably in the Saussure collection at Geneva.

*Texanus* Cresson was described from two specimens called female and male. No females with clear wings are known and a reexamination of material at Philadelphia by Mr. Cresson shows that he designated one of them as female by error. Two specimens of this species labelled "type" in the United States Museum are in reality paratypes.

This species has been redescribed from seven females and fourteen males from the localities mentioned in the habitat.

*Female*.—Medium sized, dark blue or blue green, coarser pilosity everywhere dark except on dorsum of median segment where it is whitish, finer hairs silvery to whitish; no pubescent spots on third and fourth ventral segments of abdomen; mandibles unidentate; wings fuliginous.

*Head* similar to that of *cyaneum* in general shape; clypeus usually somewhat flat at sides, arched in center, with median ridge, surface distinctly punctured, pilosity only moderately dense, silvery pubescence on sides, anterior margin black with narrow extensions under the eyes, three rather pointed teeth, no lateral processes, posterior margin broadly truncate and slightly emarginate;



frons not so deeply sunken as in *cyaneum*, distinctly punctured, moderately covered with erect black hairs; a fine silvery pubescence clothing nearly all the sunken area of the frons; ocelli with distinct grooves at outer bases; vertex sparsely punctured, erect hairs rather few, finer hairs whitish; genae distinctly punctate, moderately dense hairs interspersed with fine sericeous vestiture; inner margin of compound eyes distinctly concave near upper end, gradually convergent towards clypeus for lower half, eyes usually more approximate below than above; antennae with scape black with metallic blue green reflections, a number of rather short hairs mostly on inner surface, finer sericeous hairs vary from silvery to pale brown, pedicel with a few small hairs on inner surface; flagellum dull black with a dense covering of fine recumbent hairs giving it a black to greyish appearance according to the light; first segment of flagellum distinctly narrower proximally and shorter than second, remaining segments only very slightly narrower proximally, last segment not cut off truncately as in *cyaneum*, but tapering to a blunt point; mandibles of medium length with one rather wide tooth on inner margin not reaching to the tip; a row of four or five stout hairs on outer side and about twice that number on inside.

*Thorax*.—Anterior surface of collar with a steep upward slope to the somewhat acute crest; and distinctly rugose at anterior end, dorsal lobes small and separated by a shallow depression; punctures small and scattered, pilosity finer and smaller than in *cyaneum*, sericeous hairs pale to whitish; median depression on sides of collar not ending abruptly in a fovea but continued above to the groove between neck and collar; prothoracic lobe with a fringe of pale brown hairs; median depression on mesonotum faint or absent; depressions at posterior sides of mesonotum not as strongly marked as in *cyaneum*; scutellum may have a slight median depression; posterior margin of lateral pits fringed with silvery white hairs; postscutellum with small punctures, posterior margin with a few white or pale hairs; median segment with anterior margin of dorsum flanged, posterior margin more pointed than in *cyaneum*, whole surface of shield transversely striated or rugose and without median depression, hairs rather delicate, whiter at sides along the outline of dorsum than in the center; posterior end of dorsum sloping more gradually to hinder margin than in *cyaneum*, surface with irregular striations, punctures confluent, numerous dark hairs; stigmal groove not well marked, sides of dorsum strongly punctate behind, smaller punctures anteriorly; mesopleura and mesosternum with deep punctures and long black hairs; metapleura distinctly punctate except along metapleural groove which is somewhat bare and shiny, lateral oblique depression shallower than in *cyaneum*; petiole slightly shorter and more slender than that of *cyaneum*, punctures and hairs scattered, chiefly on basal half, finely sericeous mostly on upper half of distal end.

*Abdomen* medium to small, rather ovate, paler blue than in *cyaneum*, shining, with minute white recumbent hairs scattered evenly over the dorsal surface, first three dorsal segments without dark hairs, fourth and fifth with a few scattered punctures and dark hairs; sixth or terminal segment with hairs near posterior margin, bare along median line, dorsal segment may almost cover ventral; tip of abdomen a little more slender than in *cyaneum*; ventral segments

with dorsal flaps of terminal segment (where visible) with dark hairs along the sides, thinner or almost absent along the median line; fifth to third segments with a double sinuate row of fine punctures, but hairs only scattered; third and fourth without the pubescent areas present in *cyaneum*; second with a V-shaped double row of punctures with apex pointing forwards, but corresponding hairs not complete.

*Wings* similar to those of *cyaneum*, but without such a range of brown shades in the few specimens available; fore wings as in figures; tegulae with white sericeous hairs; hind wings with angle between median and transverse median about a right angle; discoidal leaves cubital slightly more exterior to junction of median, cubital, and transverse median than is the case in *cyaneum*.

*Legs*.—Segments with same general features as in *cyaneum*, somewhat paler blue; coxae, trochanters, and femora covered with fine white recumbent hairs; fore and hind tibiae with a dense pale brown sericeous area especially noticeable on hind tibiae; fine hairs white on other parts of tibiae; tarsi with rather pale sericeous hairs.

*Male*.—Differs from female as follows: Body color paler blue; vestiture of body denser and hairs everywhere white except on face and genae and some of the ventral segments of abdomen; the approximation of the eyes across the clypeus is more noticeable than in female, giving the face a narrower appearance below than above; middle tooth of clypeus more prominent than laterals, which are small and rudimentary; mandibles without tooth, of medium length, stout at base, tapering to a point; wings varying from somewhat dark fuliginous to hyaline with fuscous tips; abdomen more compressed ventrally and curved under at tip, similar to that of *cyaneum* male in general features except that the fine sericeous hairs are whitish.

*Length*.—Females, 16 to 20 mm. Males, 12 to 19 mm.

*Habitat*.—Dahlbom mentioned that "Zimmermann caught this elegant species in South Carolina, North America" and it has been reported from Michoacan, Cordova, Atoyac in Vera Cruz, Ventanas, Valladolid in Yucatan, and Teapa in Tabasco, Mexico. Specimens have been examined from Elkin, North Carolina; "Lou[siana]"; Texas, Dallas County, Cypress Mills, Austin, Comal County, Brownsville; from "Mex[ico]"; Alta Mira, Tampico, and Teapa, Mexico; and San Antonio, Nicaragua. These localities seem to show that it is mainly a Lower Austral form, with occasional specimens from the Tropical Zone and a possible occurrence in the southern part of the Upper Austral. No records of the habits of this species as such have been found by the writer.

## EXPLANATION OF PLATES

The following figures were drawn by the author in most cases with the aid of a camera lucida, and are only intended to be diagrammatic.

Fig. 1.—Dorsal view of thorax of *Sceliphron cyaneum*.

Fig. 2.—Lateral view of *Sceliphron cyaneum*.

a, prothorax. a<sub>1</sub>, neck. a<sub>2</sub>, collar. ac, anterior coxa. b, mesothorax. b<sub>1</sub>, mesonotum. b<sub>2</sub>, scutellum. b<sub>3</sub>, mesothoracic episternum (including pre-episternum and episternum). b<sub>4</sub>, episternal groove. b<sub>5</sub>, mesothoracic epimeron. c, metathorax. c<sub>1</sub>, post-scutellum. c<sub>2</sub>, metapleuron (including metepisternum and metepimeron). c<sub>3</sub>, metathoracic epimeron. c<sub>4</sub>, metapleural lobe. d, median segment or propodeum. d<sub>1</sub>, dorsum of propodeum. d<sub>2</sub>, end of propodeum. d<sub>3</sub>, side of propodeum. d<sub>4</sub>, stigma or spiracle. d<sub>5</sub>, fovea. d<sub>6</sub>, stigmatal groove. f, funiculus. fw, fore wing. hw, hind wing. l, lobe. mc, mesocoxa. p, petiole. pc, posterior coxa. s, stigma or spiracle. st, sting. t, tegula. 1 to 6, abdominal plates.

Fig. 3.—Ventral aspect of abdomen of *Sceliphron cyaneum* (female) showing the pubescent spots on the third and fourth segments. Lettering as above.

Fig. 4.—Hind tibial comb spine of *Sceliphron cyaneum*.

Fig. 5.—The wings of *Sceliphron cyaneum* with the cells named according to the usual nomenclature.

Fig. 6.—The same wings with the veins named according to the usual nomenclature.

Fig. 7.—Fore tibial comb spine of *Sceliphron cyaneum*.

Fig. 8.—Frontal view of head of *Sceliphron cyaneum*, female.